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TUNER  
[Chūna]

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Scope of Patent Claims

Claim 1

A tuner characterized by the possession of,

A reception mechanism for receiving, via an antenna, an electric signal of a specified frequency,

An operation mechanism for inputting a selection frequency up or down command,

A frequency switch control mechanism for controlling, in response to the operation of the aforementioned operation mechanism, the frequency of the electric signal received by the aforementioned reception mechanism to become switched by a specified frequency pitch, and

A switchable pitch alteration mechanism for the purpose of expanding, in a case where the operation by the aforementioned operation mechanism is continuous, the pitch of the frequency switched by the aforementioned frequency switch control mechanism.

Claim 2

A tuner characterized,

With regard to the tuner mentioned in Claim 1,

By the fact that the aforementioned switchable pitch alteration mechanism expands, at the time of the continuous input of the operation by the aforementioned operation mechanism, the switchable frequency pitch by switching the frequency pitch to an order of digit greater than its

counterpart of the switchable frequency pitch of the normal time.

Claim 3

A tuner characterized,

With regard to the tuner mentioned in Claim 1,

By the fact that the aforementioned switchable pitch alteration mechanism expands, at the time of the continuous input of the operation by the aforementioned operation mechanism, the switchable frequency pitch by designating, as one pitch, a multiplied value of the switchable frequency pitch of the normal time.

Claim 4

A tuner characterized,

With regard to the tuner mentioned in any one of Claims 1 ~ 3,

By the fact that the aforementioned switchable pitch alteration mechanism expands, as the continuous input time of the operation by the aforementioned operation mechanism becomes prolonged, the pitch of the frequency switched by the aforementioned frequency switch control mechanism.

Detailed Description of the Invention

[0001]

(Technical Fields to which the Invention Belongs)

The present invention concerns a tuner, and in particular, it concerns a tuner capable of swiftly switching reception frequencies.

[0002]

(Prior art)

The technology mentioned in Japanese Utility Model Application Publication Jikkai No. Sho 60[1985]-57222 Gazette is known as a tuner of the prior art. Figure 6 shows the constitution of the technology mentioned in the same Gazette, whereas in the same figure, a tuner (902) is connected to an antenna (901), a VIF circuit (903), and a microcomputer (904), whereas a channel of a specified frequency becomes selected and received via the antenna (901) depending on a signal issued from the microcomputer (904) and then outputted to the VIF circuit (903).

[0003]

Connected to the microcomputer (904), furthermore, an up button (905), a down button (906), and a display unit (907), whereas frequency up and down commands become issued to the microcomputer (904) as a result of the operations of the up button (905) and down button (906), whereas the currently selected frequency is scheduled to become displayed on the display unit (907). The station selection microcomputer (904) is hereby programmed to switch the station selection frequency at a brief constant periodic cycle immediately after the operations of the aforementioned buttons.

[0004]

According to the aforementioned constitution, a user switches frequencies by operating the "up" button (905) or "down" button (906) while referencing the selection frequency being displayed on the display unit (907). Since, as mentioned above, the station selection frequency changes at a brief constant periodic cycle immediately after the operations of the aforementioned buttons, the selection frequency becomes upped or lowered at a constant speed in a case where the up button (905) or down button (906) is being continuously pressed.

(Problems to be Solved by the Invention)

The above-mentioned tuner of the prior art is plagued with the following problem. In other words, according to the above-mentioned embodiment of the prior art, the time required for switching the frequency at one time becomes brief under the pervasion of a continuously button pressed state, and therefore, the selection frequency can be upped or lowered at a fairly high speed. In a case where the pitch of the frequency varied at one time is miniscule, however, a long time is still required for greatly varying the selection frequency.

[0005]

The objective of the present invention, which has been conceived in acknowledgment of the aforementioned problem, is to provide a tuner that is capable of, even in a case where

the selection frequency is greatly varied, arriving at a desired frequency within a brief amount of time.

[0006]

(Mechanism for Solving the Problems)

For the purpose of achieving the aforementioned objective of the invention, mentioned in Claim 1, is constituted to possess a reception mechanism for receiving, via an antenna, an electric signal of a specified frequency, an operation mechanism for inputting a selection frequency up or down command, a frequency switch control mechanism for controlling, in response to the operation of the aforementioned operation mechanism, the frequency of the electric signal received by the aforementioned reception mechanism to become switched by a specified frequency pitch, and a switchable pitch alteration mechanism for expanding, in a case where the operation by the aforementioned operation mechanism is continuous, the pitch of the frequency switched by the aforementioned frequency switch control mechanism.

[0007]

According to the tuner of Claim 1 thus constituted, the reception mechanism is designed to receive, via the antenna, an electric signal of a specified frequency, whereas the user inputs, in a case where he or she wishes to change the selection frequency, a selection frequency up or down command. Upon the input of said command by the same operation mechanism, the aforementioned frequency switch control

mechanism controls, in response to the operation of the aforementioned operation mechanism, the frequency of the electric signal received by the aforementioned reception mechanism to become switched by a specified frequency pitch.

[0008]

In the above, the switchable pitch alteration mechanism expands, in a case where the operation by the aforementioned operation mechanism is continuous, the pitch of the frequency switched by aforementioned frequency switch control mechanism. As a result, the frequency becomes switched, at one time, more greatly at the time of the continuous operation than at the normal time, and accordingly, the frequency becomes switched greatly even within a brief time.

[0009]

The reception mechanism, furthermore, is designed to receive, via the antenna, an electric signal of a specified frequency, whereas said electric signal is provided by

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compounding, with a carrier wave of a specified frequency, a signal component by means of specified modulation, and it is desirable to use said mechanism for the reception of broadcast signals (e.g., radio broadcast, etc.). The present tuner can, needless to say, be used without depending on such modulation formats as AM/FM, etc., whereas television broadcasts may instead be received, and various other embodiments (e.g., use as personal radio tuner, etc.) are also conceivable.

[0010]

The operation mechanism is unlimited so long as it is capable of inputting the user's intent of upping or lowering the selection frequency, and as such, one constituted by a frequency up and down buttons is desirable, although the same may alternatively be constituted by a jog dial, trackball, etc.

[0011]

The frequency switch control mechanism switches the frequency of the electric signal that is received by the aforementioned reception mechanism. At this time, the same reception mechanism becomes controlled in such a way that the frequency will become switched by a specified pitch. In other words, in the case of an FM radio receiver, for example, broadcast electric wave signals generally exist within a frequency band of approximately 76.0 MHz ~ 108.0 MHz. The aforementioned frequency switch control mechanism is therefore constituted to switch, at the normal time, the reception frequency by a 0.1 MHz pitch, for example.

[0012]

In the above, the switchable pitch alteration mechanism is unlimited so long as it is capable of expanding the specified switchable pitch of the normal time switched by the same frequency switch control mechanism, and as a concrete example of the constitution of the same, the invention mentioned in Claim 2 provides a tuner mentioned in Claim 1 wherein the aforementioned switchable pitch alteration

mechanism is constituted to expand, at the time of the continuous input of the operation by the aforementioned operation mechanism, the switchable frequency pitch by switching the frequency [pitch?] to an order of digit greater than its counterpart of the switchable frequency pitch of the normal time.

[0013]

According to the invention of Claim 2 thus constituted, the frequency becomes switched, at the time of the continuous input of the operation by the operation mechanism, by a frequency [pitch] bearing an order of digit greater than its counterpart of the switchable frequency pitch of the normal time. In other words, in a case where the switchable pitch of the normal time is designated at 0.1 MHz, as in the example of the switchable pitch of the above-mentioned FM radio broadcasts, for example, the frequency becomes switched by 1 MHz each at the time of the continuous input of the operation. As a result, the frequency becomes switched 10 times faster than the speed of the normal time. It goes without saying that, since the frequency switching speed simply needs to be upped in this case, the frequency may instead be switched by 2 MHz or 3 MHz each.

[0014]

As another concrete example of the constitution for expanding the switchable pitch, furthermore, the invention mentioned in Claim 3 provides a tuner mentioned in Claim 1 wherein the aforementioned switchable pitch alteration

mechanism is constituted to expand, at the time of the continuous input of the operation by the aforementioned operation mechanism, the switchable frequency pitch by designating, as one pitch, a multiplied value of the switchable frequency pitch of the normal time.

[0015]

According to the invention of Claim 3 thus constituted, the frequency becomes switched, at the time of the continuous input of the operation by the operation mechanism, by a multiplied value of the switchable frequency pitch of the normal time at each time. In other words, in a case where the switchable pitch of the normal time is designated at 0.1 MHz, as in the above-mentioned example of the switchable pitch of the FM radio broadcasts, for example, the frequency becomes switched by 0.5 MHz each at the time of the continuous input of the operation. As a result, the frequency becomes switched five times faster than the speed of the normal time. It goes without saying that, since the frequency switching speed simply needs to be increased in this case, the frequency may instead be switched by 0.8 MHz or 1.5 MHz each.

[0016]

In a case where the switchable pitch is thus switched and expanded, furthermore, there is no need to fix the pitch following the switch thereof. As a concrete example of such a constitution, the invention mentioned in Claim 4 provides a tuner mentioned in any one of Claims 1 ~ 3 wherein the aforementioned switchable pitch alteration mechanism is

constituted to expand, as the continuous input time of the operation by the aforementioned operation mechanism becomes prolonged, the pitch of the frequency switched by the aforementioned frequency switch control mechanism.

[0017]

According to the invention of Claim 4 thus constituted, the switchable pitch alteration mechanism expands the frequency pitch and is switched by the aforementioned switchable pitch alteration mechanism as the continuous input time of the operation by the aforementioned operation mechanism becomes prolonged. It is conceivable, for example, to provide a constitution wherein the duration of an operation by the operation mechanism is measured by the switchable pitch alteration mechanism and wherein the switchable pitch is expanded in proportion to the time thus measured or a constitution wherein multiple thresholds are designated in relation to a measurement period and wherein the switchable pitch is expanded on every occasion where the values thus designated are exceeded. the frequency becomes switched very swiftly from one to the other ends of the frequency band even if such a constitution is applied to a receiver bearing a broad reception frequency band.

[0018]

(Effects of the Invention)

As the foregoing explanations have demonstrated, it becomes possible, according to the present invention, to

switch the selection frequency very rapidly even in a case where the selection frequency is greatly varied. According to the invention mentioned in Claim 2, furthermore, the switchable pitch can be easily altered at the normal time and at the time of a continuous operation. According to the invention mentioned in Claim 3, too, the switchable pitch can be easily altered at the normal time and at the time of a continuous operation. According to the invention mentioned in Claim 4, furthermore, the frequency band can be switched very rapidly even in a case where the reception frequency band is extremely broad.

[0019]

(Application Embodiments of the Invention)

In the following, application embodiments of the present invention will be explained with reference to drawings. Figure 1 shows the physical appearance of a radio receiver using the tuner of one application embodiment of the present invention, whereas in the same figure, this radio receiver (10) is constituted to be outfitted, in the interior of a virtually [sic: Adjective missing] casing, with the tuner of the present invention, a circuit for demodulating and amplifying signal electric waves, etc., to possess, on the upper plane thereof, a virtually rectangular panel, and to be outfitted, atop said panel, with an LCD (17), an operation unit (18), and a speaker (19).

[0020]

The operation unit (18) possesses an up button (15) for issuing a selection frequency up command, a down button (16) for issuing a down command, a BAND button for designating switches of AM/FM broadcasts, a power source ON/OFF button, a volume adjustment knob, etc. The same radio receiver (10),

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furthermore, possesses an antenna (11) along one side of the aforementioned casing, whereas a user listens to broadcasted sounds from the speaker (19) by switching, via the up button (15) or down button (16), the selection frequency of waves received via said antenna with reference to the LCD (17).

[0021]

Figure 2 is a block diagram that shows the constitution of the interior of the same radio receiver (10). In the same figure, the tuner (12) is connected to the antenna (11), modulating/amplifying circuit (13), and microcomputer (14), whereas a radio broadcast signal of a specified frequency becomes selected and received via the antenna (11) in response to a signal issued from the microcomputer (14) and then outputted to the modulating/amplifying circuit (13).

[0022]

The tuner (12), LCD (17), and operation unit (18), furthermore, are connected to the microcomputer (14) in such a way that operations of the up button (15), down button (16), BAND button, etc. of the operation unit (18) can be inputted into the microcomputer (14). The LCD (17) is

constituted to display specified characters based on signals issued from the microcomputer (14) for the purpose of displaying the current reception band and frequency.

[0023]

The reception frequency band of the tuner (12) is 76.0 MHz ~ 108.0 MHz in the case of FM broadcast signals, whereas the corresponding reception frequency band is 531 kHz ~ 1,629 kHz in the case of AM broadcast signals, and thus, the respective frequencies of both broadcast signals are covered.

[0024]

The microcomputer (14) is hereby programmed, in a case where the up button (15) or down button (16) has become operated, to switch the frequency of broadcast signals received via the tuner (12), according to which the frequency becomes upped or lowered by a 0.1 MHz pitch based on a normal button operation in a case where an FM broadcast signal is being received, whereas the frequency becomes upped or lowered by a 9 kHz pitch based on a normal button operation in a case where an AM broadcast signal is being received. At the time of a continuous operation (e.g., in a case where either button is continuously pressed, etc.), [the frequency of?] the FM broadcast signal becomes upped or lowered by a 1 MHz pitch, whereas [the frequency of?] the AM broadcast signal becomes upped or lowered by a 36 kHz pitch.

[0025]

The tuner (12) outputs the selected broadcast signal to the modulating/amplifying circuit (13), whereas the

modulating/amplifying circuit (13) modulates and amplifies the broadcast signal thus inputted and then outputs a sound signal to the speaker (19), whereas sound waves based on said sound signal become issued from said speaker (19) for emitting sounds.

[0026]

Next, actions of the present application embodiment thus constituted will be explained. Figure 3 (a) shows displays of the LCD (17) at the time of the reception of FM broadcast signals, whereas (b) of the same figure shows displays of the LCD (17) at the time of the reception of AM broadcast signals. At the time of the LCD display a1 in (a) of the same figure, a signal of a frequency of 82.5 MHz is being received, and in a case where the up button (15) becomes pressed once, not only does the reception frequency become switched to 82.6 MHz under the control of the tuner (12) by the microcomputer (14) but the display of the LCD (17) also becomes 82.6 MHz, as indicated by the LCD display a2. In a case where the up button (15) becomes pressed once again, the reception frequency and the LCD display a3 likewise become switched to 82.7 MHz.

[0027]

At the time of the LCD display b1 in (b) of the same figure, furthermore, not only does a signal of a frequency of 729 kHz become received but the same frequency 729 kHz also becomes displayed, and on every occasion where the down button (16) becomes pressed once, the received frequency

becomes switched from 729 kHz to 720 kHz and then to 711 kHz under the control of the tuner (12) by the microcomputer (14). The LCD display (17) concomitantly becomes switched to 720 kHz and then to 711 kHz, as LCD displays b2 and b3 indicate, respectively.

[0028]

Figures 4 show display variation states of the LCD (17) at the time of a continuous button operation, where (a) of the same figure shows displays of the LCD (17) at the time of the reception of FM broadcast signals, whereas (b) of the same figure shows displays of the LCD (17) at the time of the reception of AM broadcast signals. In (a) of the same figure, in a case where the up button (15) becomes continuously pressed at the time of the reception of a signal with a frequency of 82.5 MHz, as indicated by the LCD display a4, the microcomputer (14) initially ups, by controlling the tuner (12) in response to this button operation, the frequency by 0.1 MHz, namely a 1-pitch increment of the normal time, whereas 82.6 MHz becomes displayed on the LCD (17), as the LCD display a5 indicates.

[0029]

Since the up button (15) is being continuously pressed in this case, however, the operation of the same up button (15) is being continuously inputted into the microcomputer (14). Upon the judgment, by the microcomputer (14), of the continuously pressed state of said operation button, therefore, the frequency up pitch of the next step becomes 1

MHz. Not only does the reception frequency therefore become 83.6 MHz based on the control of the tuner (12) but, as the LCD display a6 indicates, 83.6 MHz also becomes displayed on the LCD (17). This upping action by a 1 MHz pitch is continued until the continuously pressed state of the up button (15) ceases.

[0030]

Likewise, furthermore, in a case where, as b4 in (b) of the same figure indicates, the down button (16) becomes continuously pressed at the time of the reception of a signal with a frequency of 729 kHz, the microcomputer (14) initially lowers, by controlling the tuner (12) in response to this button operation, the frequency by 9 kHz, namely a 1-pitch increment of the normal time, whereas, as the LCD display b5 indicates, 720 kHz becomes displayed on the LCD (17).

[0031]

In this case, however, the operation of the down button (16) is being continuously inputted into the microcomputer (14) since the continuously pressed state of the down button (16) persists. Upon the judgment, by the microcomputer (14), of the continuously pressed state of said operation button, therefore, the frequency down pitch of the next step becomes 36 kHz. Not only does the reception frequency therefore become 684 MHz based on the control of the tuner (12) but, as the LCD display b6 indicates, 684 kHz also becomes displayed on the LCD (17). This frequency lowering action by a 36 kHz

pitch is continued until the continuously pressed state of the down button (16) ceases.

[0032]

The aforementioned explanations account for a case where the up button (15) becomes pressed at the time of the reception of FM broadcasts and for a case where the down button (16) becomes pressed at the time of the reception of AM broadcasts. However, the same likewise hold even in a case where the down button (16) becomes pressed at the time of the reception of FM broadcasts and a case where the up button (15) becomes pressed at the time of the reception of AM broadcasts, and actions respectively of lowering the frequency by a 1 MHz pitch and of upping the frequency by a 36 kHz pitch become invoked at times of continuous operations of both operation buttons.

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[0033]

Since frequencies thus become switched, at times of continuous operations of operation buttons during receptions of both FM broadcasts and AM broadcasts, and by pitches that are greater than their counterparts of the normal time, it becomes possible to switch selection frequencies very swiftly.

[0034]

Moreover, the respective switchable pitches of 1 MHz and 36 kHz at times of continuous operations of the above-mentioned operation buttons merely represent examples, and

such pitches are not necessarily binding, whereas it is also possible to switch the selection frequency more swiftly by controlling the switchable pitch to become expanded as the operation button continuous operation time becomes prolonged. Figure 5 shows examples of displays of the LCD (17) in a case where such a constitution is embodied.

[0035]

In the same figure, in a case where the up button (15) becomes continuously pressed at the time of the reception of a signal with a frequency of 82.5 MHz shown in the LCD display a7, the microcomputer (14) initially ups, in response to the operation of said button, the frequency by 0.1 MHz, namely the 1-pitch increment of the normal time, by controlling the tuner (12), whereas, as the LCD display a8 indicates, 82.6 MHz becomes displayed on the LCD (17).

[0036]

In this case, too, furthermore, the operation of the same up button (15) is being continuously inputted into the microcomputer (14) due to the persistence of the continuously pressed state of the up button (15). Upon the judgment, by the microcomputer (14), of the continuously pressed state of said operation button, therefore, the frequency down pitch of the next step becomes 1 MHz. Not only does the reception frequency therefore become 83.6 MHz based on the control of the tuner (12) but, as the LCD display a9 indicates, 83.6 MHz also becomes displayed on the LCD (17).

[0037]

Upon the further continuation of the pressed state of the up button (15), the frequency continues to be upped by a pitch of 1 MHz over a fixed subsequent period, as a result of which not only does the reception frequency become switched to 84.6 MHz, ... 88.6 MHz but, as LCD displays a10 and a11 indicate, 84.6 MHz, ... 88.6 MHz also become displayed on the LCD (17). Upon the further continuation of the pressed state of the up button (15), the frequency up band becomes switched to 2 MHz at a certain point in time, and the frequency subsequently becomes upped continuously by the 2 MHz band, as a result of which not only does the reception frequency therefore become switched to 90.6 MHz and then 92.6 MHz but, as LCD displays a12 and a13 indicate, 90.6 MHz and 92.6 MHz also become displayed on the LCD (17).

[0038]

It thus becomes possible, by expanding the frequency up pitch upon the passage of a certain period, to switch the frequency more swiftly. In this embodiment, too, it goes without saying that the frequency becomes lowered upon the switch of the pitch thereof at a certain time interval in a case where the down button (16) is continuously pressed, whereas said application example for expanding the switchable pitch to 1 MHz and then 2 MHz is not necessarily binding, and various other embodiments such as expansions of the same to 1 MHz and then to 1.5 MHz, etc. are also conceivable.

[0039]

Various methods, furthermore, are conceivable as methodologies for measuring the aforementioned certain time, and a constitution wherein, while a signal is being received via an operation button, a capacitor is recharged based on the voltage of said signal and wherein the switchable pitch is switched upon the exceeding of a certain threshold by the recharge voltage of the same capacitor may, for example, be conceived.

[0040]

The present invention is thus constituted to command a microcomputer not only to control, in response to a user's frequency up or down command, the frequencies of electric signals received by a tuner to become switched at a specified pitch but, at the time of the continuous operation of the aforementioned command, also to control the switchable pitch to become expanded. It therefore becomes possible to provide a tuner capable, even in a case where the selection frequency is greatly varied, of switching the selection frequency very rapidly.

#### Brief Description of the Figures

Figure 1: A diagram showing the physical appearance of a radio receiver that uses the tuner of an application embodiment of the present invention.

Figure 2: A block diagram pertaining to said radio receiver using the tuner of an application embodiment of the present invention.

Figure 3: Diagrams showing LCD displays, at the normal time, of said radio receiver using the tuner of an application embodiment of the present invention.

Figure 4: Diagrams showing LCD displays, at the time of a continuous operation, of said radio receiver using the tuner of an application embodiment of the present invention.

Figure 5: A diagram showing LCD displays, at the time of a continuous operation, of a radio receiver using the tuner of another application embodiment of the present invention.

Figure 6: A block diagram pertaining to a television receiver using a tuner of the prior art.

(Description of notations)

- (10): Radio receiver;
- (11): Antenna;
- (12): Tuner;
- (13): Modulating/amplifying circuit;
- (14): Microcomputer;
- (15): Up button;
- (16): Down button;
- (17): LCD;
- (18): Operation unit;
- (19): Speaker.

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Figure 1

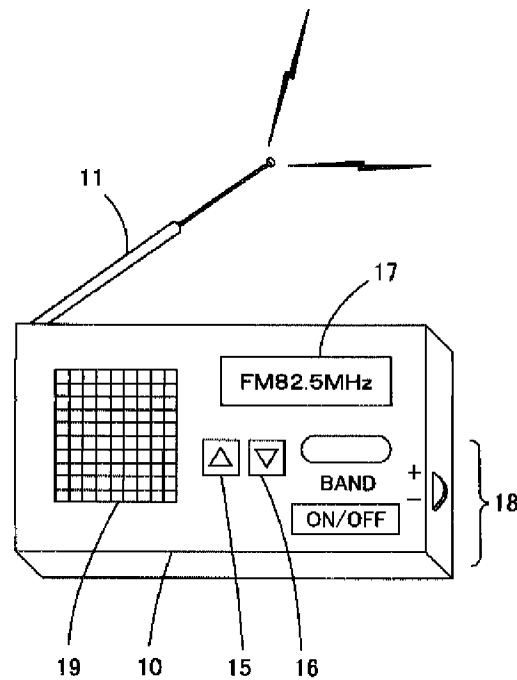
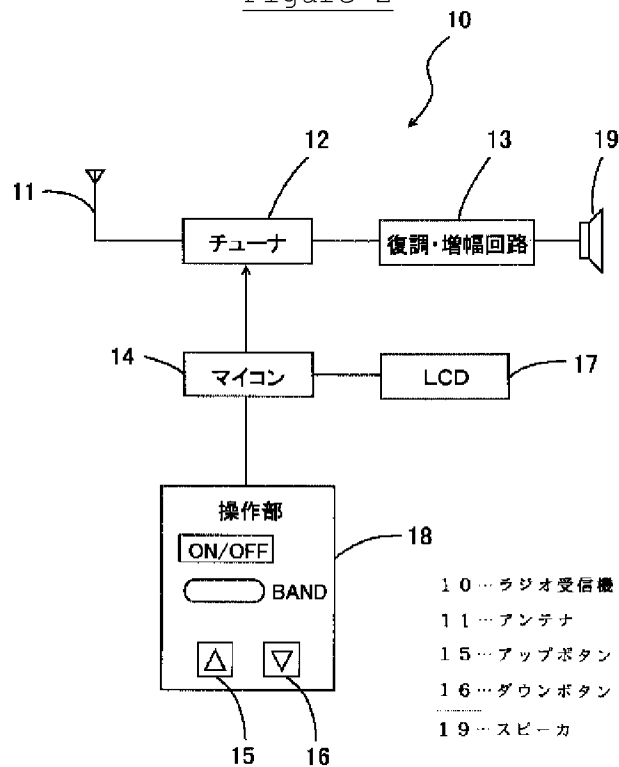


Figure 2



[(10): Radio receiver; (11): Antenna; (12): Tuner; (13):  
 Modulating/amplifying circuit; (14): Microcomputer; (15): Up

button; (16): Down button; (18): Operation unit; (19):  
Speaker]

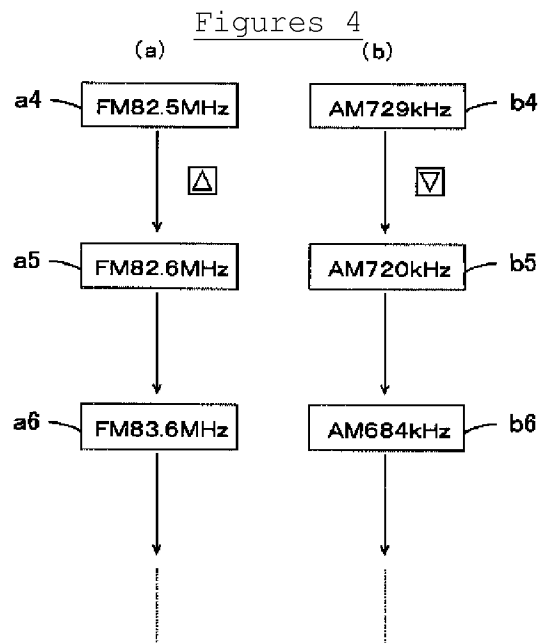
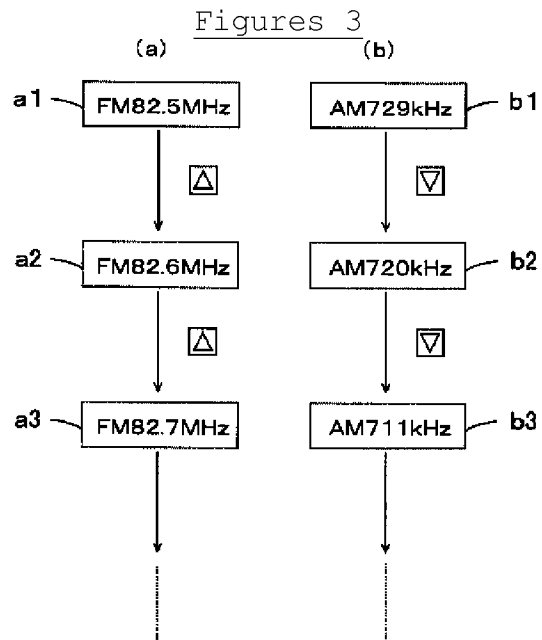
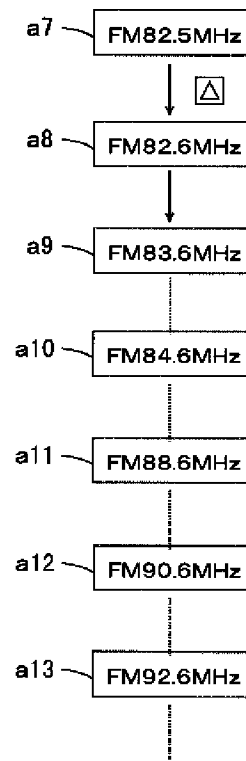
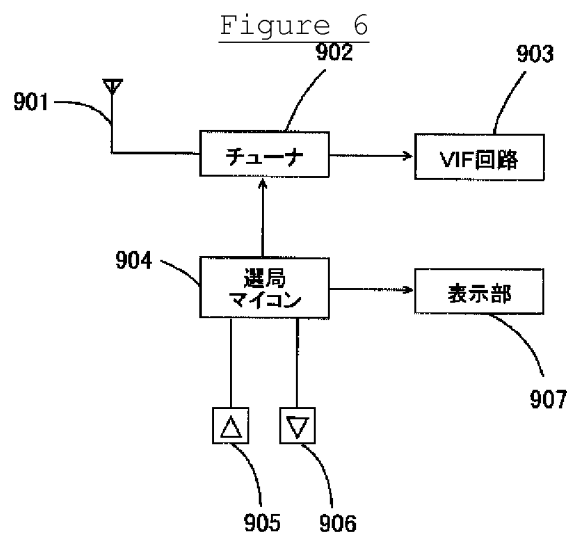


Figure 5



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[(902): Tuner; (903): VIF circuit; (904): Station selection microcomputer; (907): Display unit]